

habitat; otherwise, North America, east of the Rocky Mountains, is the nearest region in which the *Chelydridæ* are to be found. But *Chelydridæ*, and, indeed, species of the genus *Chelydra*, occur in Upper Miocene (Eningen) and in Eocene formations in Europe. Moreover, *Platycheilus*, of the Upper Jurassic series of Bavaria and Switzerland is regarded by Rüttimeyer as an early form of the group.

Lord Howe's Island is about 200 miles from the nearest Australian mainland, and something like 400 miles, as the crow flies, from the Darling Downs, in which the caudal armour, which has been ascribed to *Megalanina*, was found. The discovery of *Ceratochelys*, therefore, has an interesting bearing on the question of the former extension of Australia to the eastward, on the one hand; and of the possible derivation of such forms as *Ceratochelys* from Asia, on the other hand. An elevation of the sea bottom of 6000 feet would place Norfolk Island and Lord Howe's Island on a peninsula extending from the region of the present Barrier Reef to New Zealand; and the Floræ and Faunæ of those islands are known to have special affinities with those of New Zealand and none with those of Australia.

Speculations respecting the origin of the Chelonian carapace, are suggested by the discovery of osseous scutes in the vertebral region of the tail, and their coalescence in *Ceratochelys* to form a sort of caudal carapace, ridged in a manner resembling that of *Chelydra* and *Platycheilus*. But the consideration of these points would take me beyond the limits of the present note.

VI. "Action of Caffein and Theine upon Voluntary Muscle."

By T. LAUDER BRUNTON, M.D., F.R.S., and J. THEODORE CASH, M.D. Received March 24, 1887.

From a number of experiments we have found that caffein and theine both cause rigor in the voluntary muscles of frogs. All these experiments were made on *Rana temporaria* and none on *Rana esculenta*. The action is, however, very variable, the rigor being sometimes exceedingly well marked, and at other times not observable. The alteration does not depend on the dose of the alkaloid. When the gastrocnemii of the same frog were treated with solutions of caffein or theine of different strengths, the stronger solution had the most powerful action; but when different frogs were used, a large dose sometimes had little action on one frog, while a small dose had a powerful action on another. Theine seems to be rather more powerful than caffein, but the quantitative difference between them is slight. There is, however, a marked qualitative difference between them, inasmuch as theine tends to produce rhythmical contractions in the muscle. Complete curarisation quickens the occurrence of rigor. A

variation is observed in the action of the alkaloids on the different muscles of the same frog. In the triceps the rigor is more rapidly developed, and more extensive than in the gastrocnemius. In the sartorius rigor commences soon, increases rapidly, lasts for some hours, and then relaxes.

The addition of lactic acid to a solution of theine or caffein causes the rigor to appear sooner, develop more rapidly, and attain a greater maximum. Potash retards and diminishes the action of theine or caffeine. Guanidine produces at first its characteristic clonic contractions, but these pass off long before the rigor of caffeine or theine begins, and the appearance of the rigor is postponed as compared with the rigor of theine or caffein alone. On comparing the effect of guanidine with that of chloride of barium, we found that in the case of the guanidine the rigor was longer in occurring, and its maximum was greater than that produced by barium salts. The addition of chloride of calcium to the solution of theine quickens rigor and makes it more extensive. One phenomenon which seems deserving of attention is the rhythmic contraction of the muscle produced by theine. This rhythm is so slow that it would escape attention unless a very low rate of speed were used in the recording apparatus; it is sometimes as slow as from three to about one contraction per hour; it may continue for twenty hours. The rhythm is usually produced by small doses of theine, which do not cause a marked rigor; it may, however, occur at the commencement of what develops into a lasting rigor, or at the relaxation of a pseudo-rigor, by which we mean a phenomenon which might also be termed tetanic relaxation. The rhythm is more rapid at the commencement of its occurrence and slower towards its termination; it may be as rapid as twenty relaxations and contractions in an hour, or as slow as between one and two in an hour. The total extent of contraction and relaxation is very small, amounting to about one-fifth of a millimetre. At first the contractions and relaxations are equal in duration, but afterwards the relaxations become more rapid and the contractions slower. In one instance we observed the remarkable phenomenon to which we have given the name of pseudo-rigor; in this experiment the application of the theine was followed by slight relaxation of the muscle, to this succeeded an equal contraction, and then followed great relaxation below the normal, so great indeed that the negative curve below the abscissa strongly resembled the positive curve of contraction due to rigor in most other experiments.*

* This phenomenon is difficult to explain, but it suggests the possibility of a transverse as well as a longitudinal contraction in muscular fibre.—March 29, 1887.